

Radio- and Cathodoluminescence Study of $\text{Sr}_4\text{Al}_{14}\text{O}_{25}:\text{Eu,Dy}$

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Phosphors are generally studied through photoluminescence (PL) experiments. When exciting by means of X-rays or electrons, many phosphors also show radioluminescence (RL) and cathodoluminescence (CL), respectively. Because of the different excitation energies and pathways that are now available, additional information can be gathered.

For this work, RL and CL experiments are performed on the persistent phosphor $\text{Sr}_4\text{Al}_{14}\text{O}_{25}:\text{Eu,Dy}$, which show the emission of the Dy^{3+} ions next to of the typical broad Eu^{2+} emission that is found in PL [1,2]. Studying RL and CL thus allows to track the luminescence of both ions simultaneously, providing insight on the interactions between Eu and Dy.

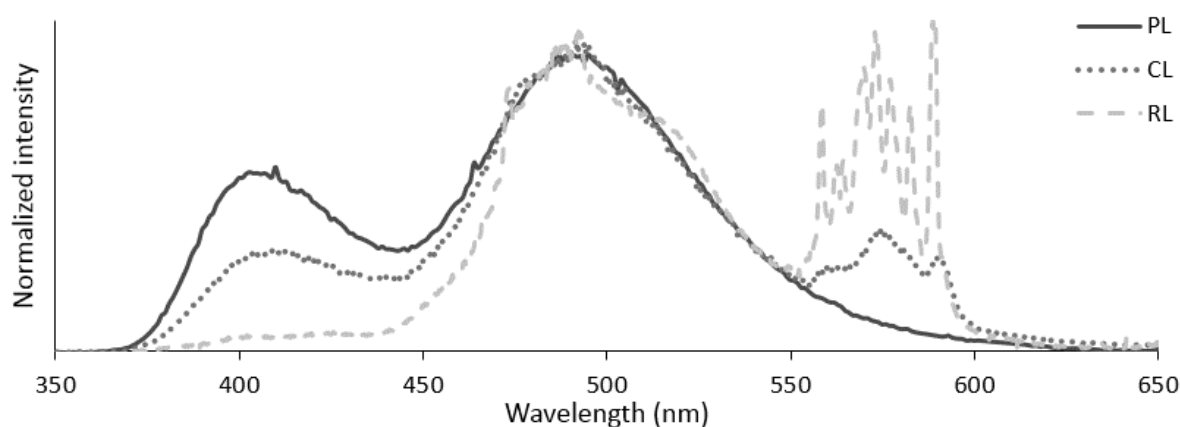


Figure 1: Comparison of PL, CL and RL spectra for $\text{Sr}_4\text{Al}_{14}\text{O}_{25}:\text{Eu,Dy}$

Since the cathodoluminescence experiments are performed in a scanning electron microscope (SEM-CL) it is possible to obtain emission maps with a high spatial resolution [4]. Equipped with an energy-dispersive X-ray detector, this setup additionally yields the interesting combination of luminescent and chemical information for micrometer-sized areas. To study the afterglow on this scale, a beam blanker is added, which allows to switch the electron beam on and off during short time intervals. Local afterglow curves are then obtained, providing insight in both inter- and intraparticle characteristics of the persistent luminescence.

Furthermore, all of the above is executed using a heating stage, which allows to control the sample temperature between -25°C and 160°C . This way, thermally resolved CL spectra and afterglow curves are investigated, as well as local thermal quenching behavior [5].

This comprehensive technique offers a wide variety of non-averaged data and is bound to reveal more details about the relevant luminescent mechanisms in $\text{Sr}_4\text{Al}_{14}\text{O}_{25}:\text{Eu,Dy}$ and persistent phosphors in general.

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